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REPORT OF THE WORKSHOP ON

Open Access to Agricultural Knowledge for Inclusive Growth and Development

29-30 October 2014

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Devika Madalli, Sonali Bisht and S.K. Soam

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1. Acronyms

AF	:	Agro Forestry
AGRIS	:	International System for Agricultural Science and Technology
AICRP	:	All India Coordinated Research Project
AIMS	:	Agricultural Information Management Standards
AIS	:	Agricultural Innovation System
CGIAR	:	Consultative Group for International Agricultural Research
CIARD	:	The CIARD Movement
CSIR	:	Council of Scientific and Industrial Research
DARE	:	Department of Agricultural Research and Education
DST	:	Department of Science and Technology
GFAR	:	Global Forum on Agricultural Research
GODAN	:	Global Open Data for Agriculture and Nutrition
GOI	:	Government of India
ICAR	:	Indian Council of Agricultural Research
IJCA	:	India Journal of Chemistry
ICRISAT	:	International Crops Research Institute for the Semi-Arid Tropics
ICT	:	Information and communications technology
IHERE	:	Institute of Himalayan Environmental Research and Education
IJBB	:	Indian Journal of Biochemistry & Biophysics
IPR	:	Intellectual Property Right
ISOR	:	Indian Society for Agro Ecology
ITRA	:	Information Technology Research Academy
KVK	:	Krishi Vigyan Kendras
MOA	:	Ministry of Agriculture
MPTS	:	Multi-Purpose Tree Species
NAARM	:	National Academy of Agricultural Research Management
NGO	:	Non-governmental organization
NIC	:	National Informatics Centre
NISCAIR	:	The National Institute of Science Communication and Information Resources
NOPR	:	NISCAIR Online Periodicals Repository
NRC	:	National Research Center
OA	:	Open Access
PGDAEM	:	Post Graduate Diploma in Agricultural Extension Management
RDA	:	Research Data Alliance
SAU	:	South Asian University
SWOT	:	Strengths, Weaknesses, Opportunities and Threats
UN-FAO	:	United Nation Food and Agriculture Organization

Executive Summary

The provisions of new knowledge, know-how, modern technology, finances and trained manpower for agriculture are some of the important requirements that together will contribute towards ensuring food and nutritional security as also economic growth with employment in India. Among these, the most tacit of all the resources needed for agricultural development in India is new knowledge. Access to knowledge is a compulsory need for millions of the country's farmers and producers to unlock their potential for increased productivity and make a sustainable livelihood from farming. More widespread sharing of agricultural data and information and their effective use as new knowledge among Indian farmers has a huge potential to result in higher all round farm productivity and incomes through better inputs, more informed production practices and increased and improved marketing. Similarly, access to agricultural data for intermediaries in India's Agri-food chains and their support systems will make these chains more efficient and transparent reducing wastage and market uncertainties that affect India's overall development. For consumers, useful data and information about food and agricultural products will provide better quality, safety assurance and improved nutrition. Overall, agricultural and Agri-food chains related information and knowledge services that meet India's emerging development needs will provide huge opportunities for investment and employment.

With an overall aim to contribute to the further development of India's agricultural knowledge systems, a workshop on 'Open Access to Agricultural Knowledge for Inclusive Growth and Development' was organized to initiate multi-stakeholder open discussions and deliberate on models, methods and techniques in opening knowledge at NAARM [National Academy of Agricultural Research Management], Hyderabad, India on 29-30 October 2014. The workshop with participants from varied stakeholder groups considered the current state of Open Knowledge in agriculture in India and explored avenues for its further development. Efforts were made to identify and recommend further strategic actions with priorities for Indian agricultural and related institutions for more open access to data, information and knowledge. Improvement of knowledge content for effective use and application not only in production but also agricultural knowledge entrepreneurship for agro-industries, agri-business and Agri services were discussed.

India recognizes that its agriculture needs to become more knowledge driven and has created Institutions to support this need. India has a large network of organizations that manage agricultural data, information and knowledge. India has a widespread access to cellular telephony and broadband Internet access which is rapidly growing and advancing in technology. It has a world renowned skills base in information services. The Workshop revealed, through a representation of initiatives and activities, the status and capacities already present in developing open access information systems in the country. However, India has not been able to rapidly enable the effective use of information and information technology to improve its Agri-food systems and value chains as required.

The weaknesses are systemic owing to institutional lacunae in terms of inappropriate policies, strategies, governance and supporting organizations, in effectively using technology and not involving the private and community sectors to enable effective use of data, information and knowledge in its Agri-food systems. There is no strategy or roadmap to enable data and information management to develop Agri-food systems in the country. Most activities in agricultural data and information management appear to be isolated and dispersed with little efforts at integration and providing standardized data and information through common platforms. The most critical weakness is the lack of capacities, especially skills among users, to effectively use data and information for decision making and innovation.

The development of effective knowledge services based on open data and information access provides huge

opportunities for developing India's agriculture in a sustainable and resilient manner, generating employment and in increasing its agricultural exports especially in high value items and commodities.

The threats to missing these opportunities lies in not investing, through the public sector, in the necessary Institutions, infrastructure, capacity development including education, enabling inclusion of the private and community sectors and taking advantage of the latest technologies.

India now needs to further elaborate its policies related to opening access to agricultural data, information and knowledge. It needs to strategize, possibly through a roadmap, on how it will improve knowledge access and use to develop its Agri-food value chains. India will need to revamp its existing Institutions and develop new Institutions and organizations for governance, management, integration and support to data, information and knowledge systems as also services for those engaged in agriculture, Agri-food systems and value chains. It has to consider investment, especially through the public sector, and with inclusion of the private and community sector for ICT infrastructure, data and information management, governance, capacity development and in organizations that process and manage data and information as a public function. India also needs to effectively use technology for its knowledge systems. For this it will need to partner with and collaborate with International and foreign agencies and technology providers. For India, this could also be an opportunity to develop a skills base to participate in International knowledge services and technology markets related to Agri-food systems and chains.

Using all the outputs from the sessions during the Workshop with the actions suggested by the delegates a Framework to further develop a Roadmap for Open Access to Agricultural Knowledge for Inclusive Growth and Development has been developed and is presented below:

Development of Policy

- There is a urgent need to enable creation of open access ecosystem in the lines of shared interests for faster and wider availability of agricultural information to all in India

Attention: GOI, MOA, DARE, ICAR, State Departments, SAUs

- There is now a need for well-defined open access policies with necessary regulations for scientific and technological information and data taking into account privacy, security of information and information systems and needs of, such as standards, for integrating information and information systems in India.
- To encourage researchers and innovators in agriculture to share information openly. Career advancement policies in MOA, DARE, ICAR and SAUs need to be linked with contribution to open access movement. Articles in Open access journals and repositories to be given equal weightage along with those in commercial high impact factor journals by deploying effective peer review process for promotional assessment of scientists.

Attention: GOI, MOA, DARE, ICAR, State Governments

- A National Strategy through Ministry of Agriculture with lead from DARE/ICAR is now needed for availability, access and effective use of agricultural data and information for effective use in inclusive agricultural development

Attention: GOI, MOA, DARE, ICAR, SAUs

- Action by DARE/ICAR, Department of Agricultural Extension and State nodal agencies for advocacy,

awareness and use of open data and information and use by all stakeholders to agriculture and agricultural development

Attention: DARE, ICAR, SAUs, State Governments

- Open access to incorporate professional ethics in respecting intellectual property rights for knowledge sharing and technological commercialization.

Attention: DARE, ICAR, SAUs

- There is an urgent need to establish Information Coordination Mechanisms at MOA, DARE and ICAR levels

Attention: GOI, MOA, DARE, ICAR

Facilitation, Hardware, Software and Connectivity development for open access movement

- Cost of new generation Wi-Fi and 3G/4G enabled smart phones and tablets to be affordable by all in India
- Broadband 3/4G Connectivity for all India for use in E-Agriculture along with e-governance, e-health, e-education etc.
- Data connectivity (broadband and 3G/4G) to be made affordable to rural areas

Attention: GOI and concerned Ministries

- Agricultural applications, especially free and developed using open technologies and available as FOSS for use on mobile devices to be promoted and supported

Attention: MOA, DARE, ICAR, SAUs

Collaboration with Public, Private, People/Community and International Organizations

- Proactive participation in International level discussions on standards for Agriculture information and knowledge resources including agriculture data with a role in setting global standards for agricultural data management and lead by incorporating these standards for Open Agriculture Knowledge and resources.
- Development of Agricultural knowledge grid starting from farm level for multilingual content development and stakeholders involvement
- Promoting and enabling appropriate use of mobile devices and Tablet PC by farmers, producers and those involved in Agri-food chains through training and learning such as through Farm schools and Village Extension workers
- Enabling development of applications by farmers, extension workers and others involved in Agri-food chains for strengthening open access movement through creative content management by users
- Stakeholder participation through Public-Private-People/Community Partnerships to create open access ecosystem for Agri-food chains and complete open access cycle i.e. data-information-knowledge-consumers-impact
- Partnership of ICAR with CIARD RING for creating CIARD RING India

Attention: MOA, DARE, ICAR, SAUs, State Departments

Capacity Development

- Curriculum changes such as integrating data sciences in library science and related disciplines, and informatics in agricultural and related (Veterinary, animal, horticulture, fisheries) sciences at graduate and post graduate levels
- Inclusion of 'Information literacy' in curriculum of course taught in Agri universities, institutes and also to be part of training for ICAR scientists

Attention: SAUs

- Developing domain specific groups for Agro-ecologies, Commodities, Farming methods involving Farmers, Extension specialists, Processors, Experts, Scientists etc.

Attention: MOA, NGOs, DARE, ICAR, SAUs

- Developing standardized data sets with enhanced authenticity and reliability from local to national level for use in agriculture and planning

Attention: GOI, NIC, MOA and other Ministries

Content Related

Promotion of good open access practices for:

- Quality information content development
- Clarifying the purpose of open access i.e. identifying collaborators, status of research, strengthening teaching community or economic aspects
- Use of appropriate standards in harmony with international standards with common formats (e.g. RDF) for data and information across the organizations for information generation (data collection) and knowledge creation (information processing)

Cost effective knowledge through open access system

- Multi-lingual authentic material generation and placing it in an agricultural information cloud with an India Agricultural RING connecting all agricultural information services
- ICAR and SAUs to develop and support development of open access applications
- Creation of Institute and University level online open repository mirrored on agricultural information cloud (as above)

Attention: DARE, ICAR, SAUs

- Strengthening open access libraries and information centres at KVKs

Attention: MOA, DARE, ICAR, SAUs

Improving quality of knowledge material with open access:

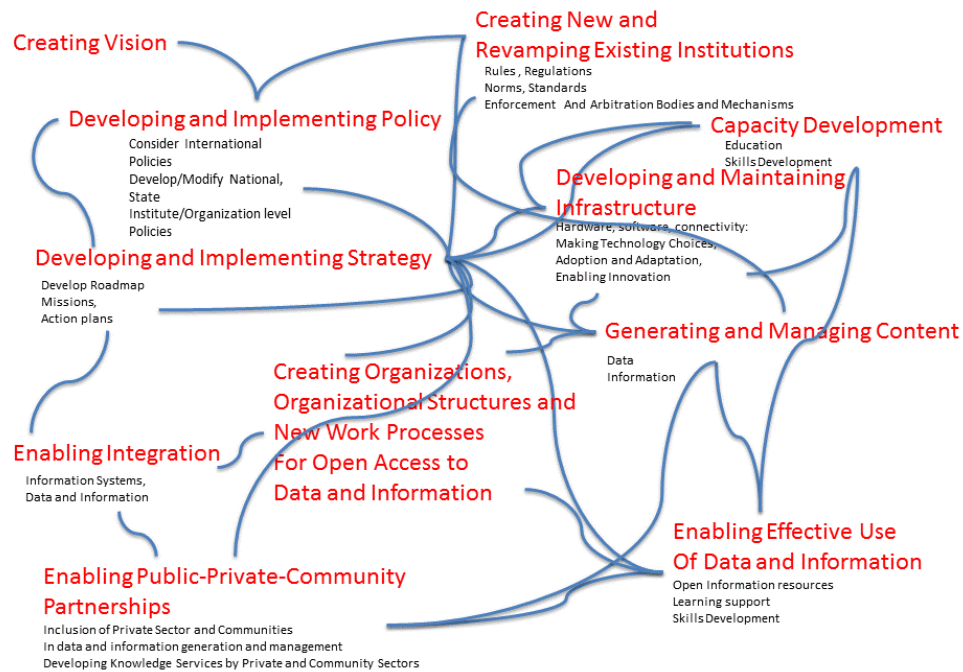
- Screening of data through institutional agencies before being made available through open access
- Compatibility with existing knowledge, up-scalable information, value addition in information and

bringing social orientation

Attention: GOI, MOA, DARE, ICAR, CSOs

The facilitators suggested a draft Roadmap for Enabling Open Access to Agricultural Knowledge for Inclusive Growth and Development in India based on the outputs of the Workshop and their experiences.

Draft Roadmap for Enabling Open Access to Agricultural Knowledge



1. Introduction

Agriculture, like other economic spheres, is becoming more knowledge and technology driven. In India, agriculture and allied activities remain the main source of livelihood for more than 56 per cent of its population. The food and nutritional security of more than one and a quarter billion people in the country depends on agriculture. For over six decades since its independence the focus in India has been feeding this massive populace. The challenge for the country, with its growing incomes, urbanization and awareness, is now shifting rapidly towards providing safe, nutritious and healthy food at affordable costs. Meeting this challenge in a country with the size and diversity of India is not a trivial task.

The provisions of new knowledge, know-how, modern technology, finances and trained manpower for agriculture are some of the important requirements that together will contribute towards ensuring food and nutritional security as also economic growth with employment in India.

The most tacit of all the resources needed for agricultural development in India is new knowledge.

Access to knowledge is a compulsory need for millions of the country's farmers and producers to unlock their potential for increased productivity and make a sustainable livelihood from farming.

More widespread sharing of agricultural data and information and their effective use as new knowledge among Indian farmers has a huge potential to result in higher all round farm productivity and incomes through better inputs, more informed production practices and increased and improved marketing. Similarly, access to agricultural data for intermediaries in India's Agri-food chains and their support systems will make these chains more efficient and transparent reducing wastage and market uncertainties that affect India's overall development. For consumers, useful data and information about food and agricultural products will provide better quality, safety assurance and improved nutrition. Overall, agricultural and Agri-food chains related information and knowledge services that meet India's emerging development needs will provide huge opportunities for investment and employment.

India, with growing urbanization and growth of incomes as also increasing participation in international trade of agricultural commodities and technologies, now has a huge multitude of actors and stakeholders in its Agri-food chains. In future, their numbers and diversity will increase. It is now imperative for India in developing its agriculture that all its knowledge resources, surmounting all barriers be they economic, cultural, technological or political reach and is accessible to all the actors in India's Agri-food systems. It can easily be deduced that meeting knowledge needs of all these actors and stakeholders in India's rapidly developing, increasingly complex, open market driven Agri-food chains will require open access to data, information and the means to effectively use them as the most basic and essential of all their supporting structures.

Sharing and Exchanging of Agricultural Information and Providing Knowledge Services

India has a long history of using technology to share agricultural information and knowledge. After independence, India embarked on using the radio for agricultural extension. In the 1980s India with the availability of terrestrial television used the medium widely for sharing agricultural information. India pioneered the use of cable TV accessed along with satellite communication for rural areas. There were experiments in using computers and digital technology in the late 1990s for sharing and exchanging farm information. India today widely uses, along with radio and TV, the Internet for sharing and exchanging agricultural information through networks of public research and development Institutions, the private sector and the civil society organization. The country now has more than 750 million cell phone users with 2G/3G and 4G country wide cellular connectivity that also allow access to the Internet. It has more than 50000 kilometers of optical fiber for digital communication. With its Digital India program, the entire country

will soon have broadband access to the Internet. This opens opportunities for India to meet the emerging knowledge needs for developing its agriculture and Agri-food systems further and rapidly.

Information and knowledge are not stagnant with the needs for and from them change every day. Coupled with the dynamics and inter-relations of the activities within and outside its related domain which itself is in constant development, they are ever growing and changing rapidly. There is an urgent need and immediacy in developing and adapting innovative and effective techniques in meeting the demands for information and knowledge in India. Therefore, information, knowledge, skills and technology to meet the new challenges of enabling access and effective use of data, information and knowledge are now needed and it is imperative to think of innovative channels of finding, accessing and utilizing new knowledge and skills. At the same time it is equally important to open up existing knowledge resources to ensure that it is utilized by a wide number of stakeholders and makes the right impact.

Affordable, quality knowledge services for agriculture and Agri-food systems in India now and in future can best be secured through partnerships of the public, private and community sectors. The public sector today holds most of the organized and structured data and information in the country and has the capacity and Institutions to continue this essential function. The private sector ranging from multinational corporations to medium, small and micro enterprises with telecommunications, hardware, software and skilled manpower has and will further the capacity and expertise to deliver information effectively and efficiently to millions of diverse users in the country. The agricultural community will soon be the main producer of the needed data and now needs to be fully incorporated in the new models of knowledge generation, sharing and exchange that are emerging in the country.

The generation and use of knowledge along with data and information is driven by research, practice, processes and exchange of thoughts among all involved in the Agri-food system but this is often not explicitly understood and recognized. There is a transformational change in the construct of agricultural research and innovation globally. Agricultural research is now considered as a component of the larger Agricultural Innovation System (AIS). These systems consider innovation occurs in systems, Institutions, technology generation and in its effective use as also in participation and involvement of communities. Innovation systems consider improving Agri-food chains and systems holistically though innovations may occur in various components and at different levels. Multiple actors, not only scientists, generate innovations in AIS.

Indian agriculture and Agri-food systems now need widespread innovations at various levels in farming from harvesting to marketing. The innovations need to focus on various aspects right from use of appropriate inputs; production, aggregation, transport and processing to how food is cooked and consumed and commodities are used in industry. These can be generated and spread only if there is exponential innovation at various levels that harnesses the innate intelligence of the 1.25 billion Indians. This again has to be a facilitated task that is only possible with open information access to all. India urgently needs to usher rapid innovation in its Agri-food systems across diverse geographies and micro climates. This is reason enough to evolve inclusive information systems that provide open access to data and information along with mechanisms for effective use by all its citizens. The potential spin-off from this approach is that this openness will in turn generate more knowledge and will elicit collaborations through a virtuous cycle. These needs require that data and information and the tools and mechanisms to effectively use them are openly and equitably accessible to all.

India has made commendable efforts in evolving new data and information systems for agriculture. India, however, struggles with transforming its Institutions, in providing appropriate policies, strategies, regulatory mechanisms, standards, organizational structures, work processes, in using cutting edge technologies and involving communities in its agricultural information and knowledge systems at the speed their development needs demand.

There are several International initiatives and projects today such as CIARD, GODAN, agINFRA, RDA etc. that advocate and support the development of open information system for agriculture and share data and information through seamless and collaborative platforms. It would be in the best interest of the Indian agriculture stakeholders to leverage on the available knowledge and resources including information, data and human capital in the form of worldwide expertise and skills available through these initiatives as also share and contribute its experiences and capacities through active participation in them.

2. Objectives of the workshop

Given the very nature of creation, dissemination, consumption and re-generation of knowledge in the present scenario it is not possible for those involved in innovating agriculture, especially researchers, to work in isolation. This applies particularly to laboratories and to specialist or research organizations. Knowledge that is not discoverable is equal to knowledge that does not exist. There are various nuances in the knowledge cycle and in order to reach the relevant sections of community for its effective use, knowledge must be visible and accessible. This is the fundamental tenet of open knowledge.

With the overall aim to contribute to the further development of India's agricultural knowledge systems, this workshop on 'Open Access to Agricultural Knowledge for Inclusive Growth and Development' was organized in October 29-30, 2015 to initiate multi-stakeholder open discussions and deliberate on models, methods and techniques in opening knowledge. The host and venue was the NAARM [National Academy of Agricultural Research Management], Hyderabad, India. The workshop with participants from varied stakeholder groups considered the current state of Open Knowledge in agriculture in India and explored avenues for its further development. Efforts were made to identify and recommend further strategic actions with priorities for Indian agricultural and related institutions for more open access to data, information and knowledge. Improvement of knowledge content for effective use and application not only in production but also agricultural knowledge entrepreneurship for agro-industries, agri-business and Agri services were discussed.

Workshop Participation

There were more than 70 participants from across the country representing different ICAR Institutes, agricultural universities and research organizations as also the private sector, Non-Government organizations and farmer organizations. Leading resource persons brought expertise in different aspects of open agricultural knowledge, contributed and led the discussions and deliberations.

3. Workshop Programme

The basic objective of the workshop was to initiate and contribute towards a framework for developing a roadmap for open information and knowledge for agriculture in India. The framework is envisaged to be holistic taking into account all actors and stakeholders involved in Agri-food systems of India.

The Workshop envisaged that:

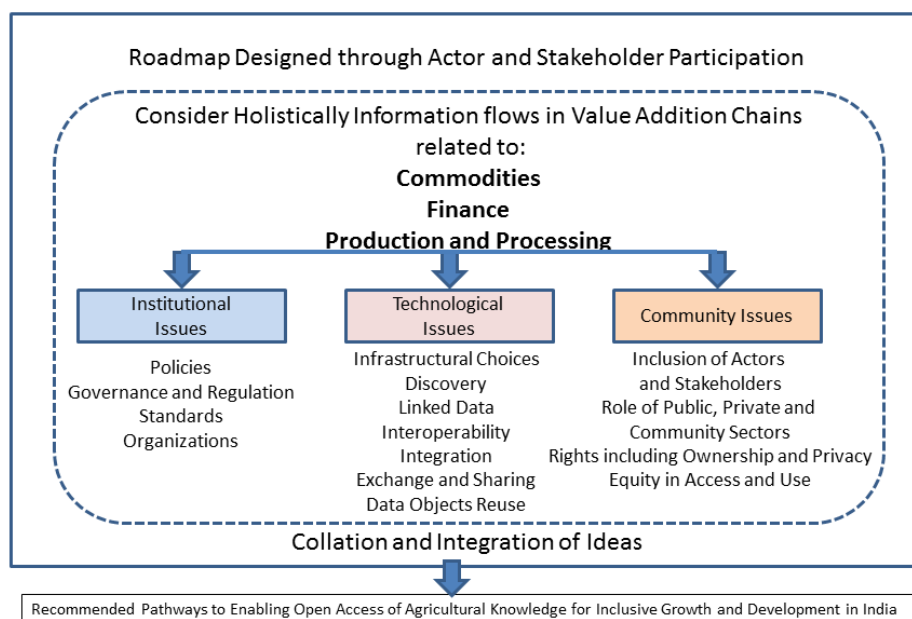
1. The development of the roadmap for open information and knowledge would be through involvement of all stakeholders and actors (through representation and more widespread discussions) in Agri-food systems in India.
2. The perspective would include considering the three flows of commodity, finance and information

(including farming process information) holistically in Agri-food systems.

3. Would include development and formulation of policy, strategies, new institutions and refurbishing old Institutions, change in organizations and organizational structures, work process, rules, regulations, norms, application of standards, governance, and community participation in sharing data, information and knowledge to bring about the innovations needed in Indian Agri-food systems and chains in addition to technology.

Thus this process has to be multi-stakeholder and multi-institutional in its approach.

Figure 1: The Workshop Design



The Workshop Programme was designed to first collate and inform participants on the various representative programs and initiatives in operation for enabling open access to agricultural information and knowledge. Invited experts contributed their experiences of these programs and initiatives through formal lectures and contributed to question and answer sessions following their presentations. The Experts also contributed as facilitators and resource persons in participatory brainstorming sessions.

One of the main aims was also to bring into focus national and international initiatives and movements and their experiences towards open access to agriculture knowledge. These were presented by illustrating national and international projects and initiatives with an objective of creating awareness of the opportunities, possibilities and potential of open knowledge for Indian agricultural communities. Accordingly, the two main panel discussion topics chosen were 'Global State of Open Knowledge Movement in Agriculture' and the other on 'Current State of Open Movement in Agriculture in India'.

The discussion on the global scenario threw open to the participants the opportunities in harnessing open agricultural knowledge offered through innovative services and user friendly platform of international open knowledge initiatives and agencies such as the CIARD, GFAR, agINFRA, RDA, UN-FAO and ICRISAT/CGIAR. Being a part of the global community, Indian agricultural data and information systems need to further collaborate with international initiatives and communities as in CIARD and its partners activities including agINFRA, CIARD.RING, AIMS, AgriVIVO, Agripedia, AGRIS etc. as well as with GODAN, GFAR and FAO.

Exploration of approaches and ways to engage with these systems, information paths and utilities were some of the topics included for discussion.

The discussions on national initiatives and programs under the broad theme of 'Current State of Open Movement in Agriculture in India' included several speakers who presented interesting work being carried out in various ICAR labs, universities and institutes as also by the private and NGO sectors currently involved in knowledge creation and agricultural content development, services and dissemination activities. Several initiatives and programs in open knowledge were presented including Digital Green, Open Access in Agro forestry and Open access initiatives at NISCAIR. The efforts in capacity building with open access training material were some of the interesting presentations in these sessions.

The Programme emphasized and stressed inclusive and proactive participation of the delegates. The participatory sessions were structured and designed for identifying the challenges and possible solutions to open access to agriculture knowledge and enable it to reach all farmers and other stakeholders in agriculture. There were inclusive discussions with ideas originating from the delegates on these key issues and challenges in opening agricultural knowledge in the Indian context.

The brainstorming in the Workshop was on three important aspects in Open data knowledge with respect to Indian Agriculture. These were to collectively examine the status of open agricultural information in India, identify the needs and necessary actions as components of a roadmap and seek collaboration and support for the identified actions in the road map.

The first step in the structured participatory discussions held on the second day of the Workshop was a SWOT analysis on Opening Agricultural Information (including data) in India. The 70 delegates were randomly distributed into four groups which were further divided into smaller groups of 8-10 each for discussions. The second step of these discussions was to brainstorm how the identified weaknesses and threats could be converted into strengths and opportunities and identification of needs to improve open knowledge access and use for agriculture in India. The third step of the discussions was towards identifying appropriate actions for a Roadmap to improve open information and knowledge access for agricultural development in the country. The fourth step was to discuss the national and international collaborations needed around the actions identified to achieve expected results and impact from them. There were facilitated discussions among participants following the plenary presentations from the groups at each step on issues such as open knowledge creation, awareness, ICT facilitation, capacity building, IPR policy and institutional support and such other topics that need direction in progressing towards an open knowledge environment.

Based on the information collated during the Workshop and the recommendations of participants for the Roadmap, the facilitators drafted a possible Roadmap for enabling Open Access to Agricultural Knowledge for Inclusive Growth and Development for India.

4. Technical Proceedings

Proceedings of Technical sessions held on 29th October 2014,

Day 1 of Workshop

The workshop opened with a brief and informative inaugural session. Dr. D. Rama Rao, Director, NAARM, in his welcome address to dignitaries and the participants, stressed upon the need to deliberate on the significance of open access knowledge in agriculture. Dr. Murali Mohan, Head, Big Data Initiative, DST, GoI, appreciated the work and thinking towards opening up knowledge resources in an important domain such as agriculture. Dr. Mohan highlighted the DST agenda and invited ideas towards open data sets and stressed the importance of innovative applications using open data. Dr. M. Moni, Ex. Dy. Director General, National

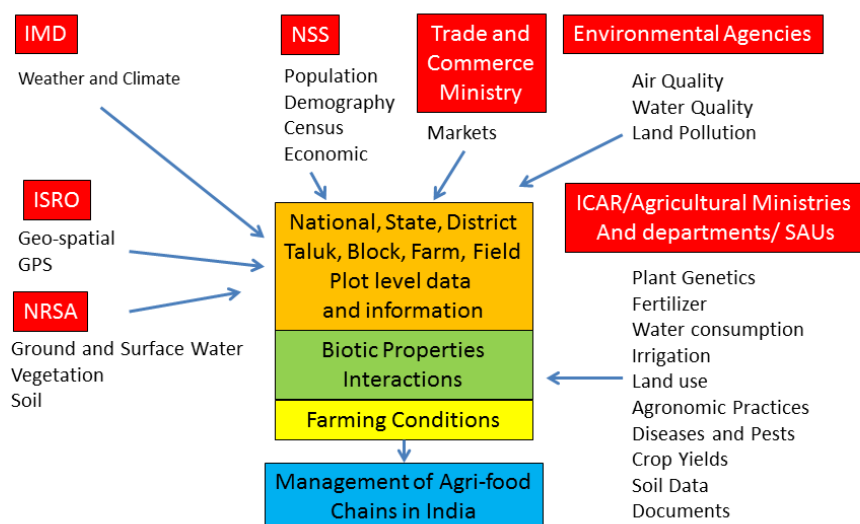
Informatics Centre (NIC), and Government of India in his address outlined the importance of open knowledge. He stressed upon the need for capacity building to foster open knowledge.

Dr. Ajit Maru (GFAR Secretariat) in his address drew attention to the need for innovations to meet the new challenges for India of not only being able to feed the masses adequately but also developing the capability to feed its population with affordable, safe, nutritious, healthy, quality food, to produce industrial feedstock for Agro-industries and the ability to generate employment especially for educated youth in rural areas. He further explained that the challenges have to be faced also taking into account the important factors that directly impact agriculture such as climate change, loss of Agro-Biodiversity, diminishing access to Natural Resources and rising energy and fossil fuel costs, rapid spread of Trans-Boundary diseases and Pests and participating in highly competitive domestic and international markets.

He elaborated that to meet these challenges India now needs to make its agriculture more knowledge intensive and knowledge based. Further India has to recognize that information and knowledge are critical inputs for entire Agri-food chains that can leverage the effective and efficient use of other farm inputs, improving productivity and for participating in competitive markets for agricultural products. He stressed that India theoretically has various options from being totally closed to being totally open for developing its agricultural information and knowledge systems. A blueprint to integrate publicly available data from various organizations that would immensely contribute to modelling India's varied Agri-food systems and use them for agricultural decision making was presented by him.

He stressed that policy and structural choices made now for its agriculture related knowledge systems will define how India's Agri-food chains develop in future. If India chooses a path for equitable and inclusive development, which in his opinion was a must, India has to facilitate the development of open knowledge systems that are equitable and inclusive for all actors and stakeholders (which is the entire Indian population) to its agriculture and Agri-food systems.

Figure 2: A blueprint to integrate publicly available data for agricultural development in India



Dwelling further on the issue of open data and knowledge, he emphasized that open access to data and

knowledge would contribute:

- In the generation of new information and knowledge
- Localize globally available information and knowledge and enable it to be used more effectively
- Increase efficiency and effectiveness of research and its outputs and innovation in terms of time, cost, quality and human effort
- Reduce reinvention and repetition of research efforts
- Allow greater inclusiveness and participation in research and innovation
- Bring cross-disciplinary and specialized skills to agricultural research and for innovation
- Reduce inability to use research outputs effectively and/or efficiently
- Create new research directions and avenues
- Bring greater equity in using agricultural knowledge across and among communities

Dr. Maru briefed the audience on the various benefits of open access to data in the context of growth and development in India especially in improving efficiency of Agri-food chains and the creation of investment and employment in agricultural knowledge services.

As representative of GFAR Secretariat, Dr. Maru discussed the activities of major international actors in Agricultural Development such as World Bank, UNO including FAO, CGIAR and pointed out that they all follow open data and information policies and open data models for their data and information management.

Dr. Maru urged that the agricultural establishment should further engage and involve more formally with the national and international movements supporting and facilitating these movements. He reiterated that India can both benefit and contribute to efforts such as the CIARD movement and pointed out that India is a key player in the Agriculture domain and the global community waited eagerly in anticipation for it to be a leader in this area.

Session: Global State of Open Knowledge Movement in Agriculture

Chairman: Dr. M. Moni, Former Director General, National Informatics Centre (NIC), Government of India

Co-chair: Dr. K.R. Murali Mohan, Advisor, Department of Science and Technology (DST), Government of India

Rapporteur: Dr. G.R.K. Murthy

Presentation I: “The CGIAR and Open Knowledge Actions” by Dr G. Dileepkumar, ICRISAT

Dr. Dileepkumar stated that Innovation is an important factor to be emphasized while promoting Agricultural Innovation. Agricultural knowledge in open access mode is an important factor to be emphasized here. There is a need to think of new ways to disseminate knowledge to the needy in shorter time. . The speaker felt that there is a mismatch in understanding between domain specialists and technology providers. This attenuates the need to make data flow in open access (OA) mode. OA initiatives at ICRISAT started in 2009. ICRISAT has been implementing a data management policy since March 2014 - Knowledge sharing through Open Access repositories, Open educational courseware and concept of ‘One agriculture and One science’ are some of the initiatives promoted and successfully run by ICRISAT to enhance openness in accessing the content. ICRISAT initiatives as a global educational consortium have been well received by more than 180 countries. Behavioral changes in the OA stakeholders, dealing with data ownership, need to maintain confidentiality, need to integrate data into central repositories are some of the challenges to promote OA in agriculture. A new initiative of ICRISAT called Green Phablet is to be launched soon. It is

expected to work as a mobile village knowledge center and will contribute towards increased openness in knowledge access.

Presentation II: “CIARD, GODAN and FAO actions in Open knowledge” by Dr. A.R.D Prasad, DRTC, ISI, Bengaluru , “AGInfra/RDA and open access movement” by Dr. Devika Madalli, DRTC, ISI, Bengaluru

Both the speakers from Indian Statistical Institute stressed the importance of OA and the initiatives like CIARD, Big Data, GODAN, AgInfra which are advocating Agri knowledge in semantic form for quicker and precise access of the needed information or datasets. Issues pertaining to retrieval of linked data, data exchange, interoperability, Object reuse and exchange, data curation need to be addressed while formulating standards and roadmap for OA in agriculture. While complementing that Agri domain as the largest dataset provider in the website data.gov.in related to clustering the data resources, the speakers felt that many institutions in India in Agri domain should join the OA movement. Organizations like ICAR can consider joining Research Data Alliance (RDA) groups to contribute and share its rich knowledge.

Technical management of data and knowledge resources needs among other requirements, skills to manage datasets and also knowledge of the necessary tools and techniques. Compliance with international standards sets the stage for data sets to be interoperable. In the present day scenario scientists and work in scientific labs is no longer in isolation but in a global community setting. Interoperability is the ability of databases to be able to exchange resources seamlessly and it is technically managed through standards in architectures and metadata. It is absolutely imperative that sets are made open and are accessible to realize the true potential of OA in agriculture.

There are success stories of international initiatives that have focused on the overriding issues in achieving OA knowledge. CIARD, GFAR, GODAN, RDA are some of the initiatives that have set the stage for cooperation of stakeholders worldwide, to collectively contribute and also exploit the advantages of OA knowledge resources. Indian Agriculture domain would stand to gain immensely, learning from such initiatives and adapting some of the useful products they offer.

Presentation III: “Open Access and Natural resources conservation” by Sonali Bisht, Institute of Himalayan Environmental Research and Education (INHERE), Uttarakhand.

Agriculture has a close and symbiotic relationship with natural resources which is understood by farmers in its site specific uniqueness. Natural resources are a major source of input in agriculture for smallholder resource poor farmers. Natural resource based agriculture depends on traditional knowledge acquired by smallholder farmers through millennia and still evolving. Farmers need to be recognized as co-creators of knowledge in agriculture, natural resource conservation and utilization. Open access and digital formats should mainstream these knowledge systems while protecting ownership and benefits of knowledge creation and utilization.

It is difficult for farmers to contribute directly to formal knowledge systems though knowledge is shared openly and informally among peers. The knowledge of farmers as agriculture practitioners operating in micro climates and unique geographies of a large and diversified country like India can be extremely important to fellow farmers in similar geographies. NGOs engaged in agriculture research and development projects and programs as important stakeholders need to be involved and trained to contribute to

agriculture knowledge systems on behalf of the farmers as well as to help farmers to access knowledge required by them available in open access domains.. Other civil society organizations including farmers' organizations also require to be brought into the fold and trained, both to contribute and to help farmers' access knowledge relevant to them. This means that the collated agriculture knowledge would also need to be translated into local language and idiom to be understood and useful to farmers. The content must focus to be of use to smallholder, resource poor and vulnerable farmers with limited education who are the majority of our farmers in India and the developing world. This will enable more effective decision making, innovation and improved productivity and incomes.

Remarks by Co chair: Dr. K. R. Murali Mohan

With regard to OA, three broad issues need to be addressed. These pertain to evolving data sharing standards, interoperability across platforms and enhanced ease of data accessibility. We can create our own national data sharing standards or adopt existing international standards. These are important decisions and should not be delayed. If we decide to adopt prevailing international standards then it is important to first understand them and their implications. Existing data should be made accessible in whatever form it is and then standardized as per need. Agricultural domain for our country is required to take part in international fora and contribute to evolving proper standards.

Remarks by Chairman, Dr. M. Moni

ICRISAT's efforts on OA are replicable and can be promoted through proper capacity building measures. Natural resources accounting at Panchayat level is very important. There is disconnecting among the organizations/ groups working for a common cause like sustainability in agriculture. Multidisciplinary and multi-stakeholder coordination and cooperation are important. Instead of addressing issues at a discipline level, it will be useful to consider block/panchayat as a focal point due to site specific issues in agriculture. Advocacy in open and inclusive fora is needed. The base level curriculum in agriculture needs to be revamped to promote open access culture and knowledge based agriculture. Subjects like Library and Information science should be made mandatory at school level to take advantage of the current ongoing OA movement.

Technical Session II

Session: Current State of Open Movement in Agriculture in India

Chair : Dr. A.R.D Prasad

Co- Chair: Dr. Sanjay Burde

Rapporteur: Dr. P.Venkatesan

Presentation-I: Open Knowledge for Agriculture- Perspectives and Actions of ICAR, Dr. Rameshwar Singh, Director, ICAR- DKMA, New Delhi

The presentation focused on information and current state of deliberation on perspectives and actions of the Indian Council of Agricultural Research on the open access system. It addressed the issue of open access journals and their usage, recently added journals in open access and the difficulty of putting some kinds of journal under open access, for example Indian phytopathology. Information was given on the number of readers accessing online journals and their reach. This was elaborated and substantiated with number of articles downloaded over the years with information on the hits and downloads recorded each year. Availability of e courses and e prints was increasing as open learning resources were getting popular and demand for them growing. New initiatives were being taken such building of Krishikosh, general and

commodity specific knowledge portals. In this overall context the policies of ICAR on open access were highlighted.

Presentation-II: Open Knowledge for Agriculture Extension, Dr. V. P.Sharma, Director (ICT & Documentation), MANAGE, Hyderabad

In his session Dr.V.P. Sharma highlighted his views on the envisaged Kisan Call center and highlighted its importance. He explained the SMS gateway, which was accessible after 16th July 14. Further he touched upon the audio database and its indexing. Dr. Sharma also presented linguistic based information sharing of course materials put together for PGDAEM students of MANAGE in Hindi, Tamil and Telugu. He enumerated the importance of the sites www.farmer.gov.in, www.mkisan.com and ExtensionPedia and its usage.

Presentation-III: Framework for agriculture content development: esagu and eAgromet experiences, Dr. P.Krishna Reddy, Professor, IIT- Hyderabad

In his session Dr. Krishna Reddy shared his experience in knowledge content development and presented ITRA- Ag & Food. He briefly explained building decision support system with examples of Open Access Knowledge/information and tools. In his talk he emphasized the characteristics of open access knowledge and stressed upon their importance. He presented esagu, a content development framework and eAgromet system. Further he introduced the term 'Infocrop' pointing out the issues of open access to agricultural knowledge.

Presentation-IV: Sahaja Aharam: Experience for Open Farming Knowledge, Dr.G.V.Ramanjaneyulu, Executive Director, Centre for Sustainable Agriculture, Hyderabad

The presentation shared the experience of Sahaja Aharam, a Farmer Producer Organization and framed open access to knowledge in this context. Farmer producers as well as communities of practice in agriculture such as the international Agricultural Biodiversity Knowledge Community, Indian Society for Agro Ecology (ISOR) believed in open access to knowledge and to sharing among community members and across communities of practitioners. Collaborative innovation involving multi stakeholders with their strengths is required for scaling up. This requires sharing but also protection of individual efforts and contributions. Examples were given of open seed systems and its roadblocks, bio piracy cases, appropriation of traditional knowledge through patents. There is need to move beyond free access and protect generators of knowledge and to make research using open access knowledge more transparent and responsible.

Day I: Technical session-III

Session: Current State of Open Movement in Agriculture in India

Chairman: Dr Rameshwar Singh

Co-chair: Dr Devika Madalli

Rapporteur: Dr K.H. Rao

In this session, 5 speakers narrated the OPEN ACCESS initiatives carried out in their respective organizations and shared their experiences during the initiation, development, implementation and refinement. The salient features of their presentations are as follows:

Presentation-I: Digital Green: Experiences in open agricultural knowledge

Mr. Pritam Nanda, General Manager, Digital Green, Hyderabad showcased the mission of their organization as “Last mile farmer reach using open agricultural knowledge and innovative ICT”. He claimed that human mediated and video aided extension was 10 times more efficient and user friendly than the other methods. Digital Green uses social organization and technology to improve the efficiency of the extension system. Progressive farmers proved to be the best resource to transfer the technologies to the next generation very effectively. The frame work of Digital Green encompasses three components, Initiation-Production-Diffusion. The initiation is divided into mobilization, situational analysis and training while production is divided into topic identification, story boarding, shooting and editing. Diffusion happens through dissemination, adaptation and reporting. The platform projects key analytics which depicts data charts, graphs by time line, district wise, village wise with the details of the farmers who have adopted the technologies.

Presentation-II: Agro Forestry research: Open Access

Dr S.K. Dhyani, Director, NRC on Agroforestry, Jhansi shared the information obtained from different centers of AICRP on agroforestry through open access. He opined that agroforestry is one of the best options of diversification for economic returns. He explained the different activities undertaken and the types of data collected in “agroforestry BASE”. He also discussed database on multi-purpose tree species (MPTS), Agroforestry (AF) interventions, Tree growth modelling and economic analysis database in use. Information was given about world agroforestry database and FAO agroforestry database.

Presentation-III: Open Access initiatives in CSIR

Dr Sanjay Burde, Principal Scientist, NISCAIR, New Delhi discussed in detail the NISCAIR Online Periodicals Repository (NOPR), Online Publishing System for Online Article Submission and the CSIR Central (CSIR IR) repository. CSIR has launched two journals, namely Indian Journal of Chemistry (IJC-A) and Indian Journal of Biochemistry & Biophysics (IJB) in Open Access mode during 2008. NISCAIR's online repository today holds more than 26000 full text articles and users from more than 140 countries with about 41 lakh downloads. It made the articles searchable in all major search engines. He informed the house that the online publishing system for online article submission and open access initiatives contributed to the growth of impact factor for CSIR journals. CSIR Central enables the research community to search and view the R & D literatures from different CSIR Institutes through a single console.

Presentation-IV: CeRA, Koha and the open access to agricultural information

Dr A.K. Jain, Principal Scientist and former ADG explained in detail the CeRA, e-Granth, KrishiKosh and Koha. He informed the house that CeRA members have 24 X 7 online accesses to select through IP authentication and 147 Institutions of NARS get access to CeRA. He observed that more than 7.0 million articles were downloaded between Jan 2008 and Dec 2013 which resulted in savings of more than INR750 million. E-Granth platform provides union catalogue, digital repository and digital library. AgriCat has been developed as a group catalogue of 12 partner libraries. It provides versatile search and retrieval facilities, virtualizes the complete experience of physically visiting the library and facilitates sharing of library resources which can be accessed on 24x7 bases.

KrishiKosh provides ready software platform, similar to ‘Cloud Service’ for individual institution’s self-managed repository with central integration of all individual repositories. Agrotagger is a software tool developed by IIT, Kanpur for automatic generation of keywords for agricultural documents which has been integrated with KrishiKosh to provide for more intelligent search. ICAR has implemented Koha-open source Library Management at 38 partner institutions. He urged the house that efforts should be made to bring

synergy between librarians and researchers.

Presentation-V: Open Access Capacity Building initiatives at NAARM

Dr S.K. Soam, Head, ICM division at NAARM described the open access initiatives carried out at the academy. He explained the building of National Geo-spatial library at the academy and its access to the wide spectrum of stakeholders. He expressed the satisfaction of implementing Koha software at NAARM within the record time of 8 months. He discussed vividly the initiation of establishing e-prints@naarm, AHP analyser, Log frame and also the capacity building of university teachers in using MOODLE software in agricultural education.

Day II:

Breakout Sessions

Chairman: Dr.A.R.D. Prasad, Head, DRTC, ISI Bangalore

Co-chair: Ms. Sonali Bisht, Adviser, INHERE, Almora

Day II concentrated on brainstorming on three important aspects in Open data knowledge with respect to Indian Agriculture. The sessions were as follows:

Session-I: Moderator: Dr.V.P. Sharma, Director, (ICT & Documentation), MANAGE, Hyderabad

Step 1. SWOT of the Open Knowledge for Agriculture movement in India

The collated SWOT from the Working groups is illustrated in Table 1.

Strengths	Weaknesses	Opportunities	Threats
Large amounts of agriculture information and data in public domain and freely shared community domain.	Lack of knowledge of ICT and open access to data and information among scientists and research managers	International initiatives and projects such as GFAR, CIARD, GODAN etc. supporting data and information sharing.	Withdrawal of open access knowledge due to unresolved IPR Issues
History of using technology to share agriculture information and knowledge.	Lack of organization level policy support of open access publishing and access of data and documents	Open access digital libraries	Absence of well-defined open access policies with necessary regulations
Large institutional research network generating and validating knowledge and innovation	Lack of awareness about international collaborations.	Rapid ICT development with Countywide cellular and Internet connectivity and access to information and knowledge	Absence of advancement policies encouraging researchers and innovators to share freely.
Large pool of practitioners and skill base for creating, adapting, innovating and using knowledge and information.	Lack of awareness about importance of standards and compliances related to data and information.	Development of sustainable Agriculture and Agri-food processing industries.	Unaffordability of data connectivity and equipment

Availability of content in various formats	Absence of advancement policies encouraging researchers and innovators to share openly.	Access to global markets for India's agricultural produce.	Lack of or creation of weak, ineffectual Organizations, Capacity Development, Governance mechanisms
Widespread All India coverage for Cellular Telephony and Growing infrastructure for 3G/4G and Broadband Internet connectivity with more than 750 million cellphone and more than 230 million Internet Subscribers.	Absence of information coordination mechanisms across institutions; Content is not easily accessible and divorced from needs	Vast potential for offering knowledge services to Agri-food systems and value chains	Lack of public investment and encouragement of private and community sectors to participate
Right to Information a Constitutional right. Open Access to Information policy now established for major Agriculture related Institutions.	Data sciences not adequately integrated into library science.	Can contribute to global Information Technology market if it systematically develops its capacity to manage agricultural data and information	
Large demand for agricultural data and information	Absence of multi-lingual authentic material		
	Lack of openly accessible, standardized, structured data		
	Lack of a Strategy/Roadmap to develop agricultural data, information and knowledge sharing and use		
	Lack of capacities to effectively use data and information from multiple sources by actors in Agri-food systems by smallholder farmers, especially women		

Step 2: Converting Weaknesses into Strengths and Threat into Opportunities

There is a need for enlisting and prioritizing actionable items in order to transform the weakness into strength.

Step 2 was identification of the needs to strengthen open knowledge access and use for agriculture in India

and make full use of new opportunities. During the discussion the participants came up with essential needs that are to be addressed en route to achieving open access knowledge and its fruitful utilization. The needs identified are:

1. Need for boosting the infrastructure (both physical and e-infrastructure) to scale up to meet the requirement of open knowledge in the agriculture sector.
2. Need for well-defined open access policies with necessary regulations for scientific and technological information and data taking into account privacy, security of information and information systems and needs of, such as standards, for integrating information and information systems in India
3. Need for awareness and compliance with world standards for data and information representation and exchange
4. Need for building trust in open knowledge arena through quality assurance
5. Need for capacity building programs to increase the level of competencies in terms of both knowledge and skills required to generate, manage, package and disseminate open access knowledge
6. Need for advocacy, awareness and outreach programs to increase exposure international programs, projects, processes and standards that would encourage use of the same in Indian agricultural Open knowledge generation, its handling and use
7. Need to mobilize interests of all sectors of stakeholders and encourage interaction and community participation in achieving open knowledge systems

Session-II: Moderator: Dr. Krishna Reddy, Professor IIIT, And Hyderabad

Step 3. Actions to further strengthen Open Knowledge for Agriculture in India including for Agricultural Knowledge Entrepreneurship.

Participants discussed ways and means of strengthening Open Knowledge for Agriculture. Several actionable points emerged from the discussions. The list of recommended actions to overcome the challenges and to address the needs of the sector is as below.

1. ICAR and Indian stakeholder community should follow and promote best practices in open access to knowledge.
2. All measures to create an open knowledge ecosystem should be taken. Implement infrastructure and standards for creation and management of open knowledge.
3. Pronounce clearly IPR related rules and issues so that scientists are quite clear when they use open knowledge resources or when they publish content as open resource.
4. Incentivize and encourage scientists to participate in open access. Career advancement policies in MOA, DARE, ICAR and SAUs need to be linked with contribution to open access movement.
5. Incorporate the latest cutting edge technology to facilitate the generation, management and dissemination of open knowledge.
6. Encourage actors and stakeholders to engage and proactively participate irrespective of the sectors and forge private-public-people partnerships to realize and foster Openness in the knowledge transactions.
7. Take measures for capacity building to help in creation of open knowledge and data resources and ensure seamless and effective use of the same.
8. Put in place necessary policy, technology and infrastructure support compliant with world standards for creating quality content.

Session-III: Moderator: Dr.Devika Madalli, DRTC, ISI, Bangalore

Collaborations within India between Public, Private and community sectors in India and with International

actors in Open Knowledge

Practitioners in farming and processing are innovating traditional knowledge while also acquiring, using, adapting and innovating using modern knowledge. These individuals, communities, NGOs and the private sector, made up of micro, small, medium and large corporates are working with farmers and their organizations and continuously generating useful information and knowledge. They all need to be brought into the loop of information procurement and distribution.

Based on the presentations of experts and discussions the following collaborations were suggested:

1. Collaboration between MOA, DARE, ICAR and SAU levels for setting up information coordination mechanisms is required.
2. GOI, NIC, MOA and other ministries need to collaborate for developing standardized data sets for enhanced authenticity and reliability.
3. Partnership of ICAR with CIARD RING India.
4. Partnership by ICAR with international initiatives such as GFAR, GODAN, RDA, UNFAO to build on existing knowledge and practices worldwide and to exploit the same for Open Knowledge in Indian agriculture.

Facilitators Summary

It is imperative for India to improve its agricultural productivity sustainably and with resilience. India faces major challenges in making food accessible, affordable, safe, nutritious, and healthy and of high quality to feed its 1.3 billion population, provides its agro-industries with feedstock and generate employment, especially in rural areas. Fifty six percent of its population is dependent directly or indirectly on agriculture related livelihoods. India is also a major exporter of agricultural commodities and has potential to grow in this area also. The primary agricultural sector generates about 14 per cent of India's GDP though agro-industries, agri-business and the small but growing agro-services could be contributing almost 30 per cent to the GDP. The Indian Government aims to increase agricultural growth to 8 per cent annually.

The provisions of new knowledge, know-how, modern technology, finances and trained manpower for agriculture are some of the important requirements that together will contribute towards the desired agricultural development in India. Among these resources, the most tacit is new knowledge.

India, with growing urbanization and growth of incomes as also increasing participation in international trade of agricultural commodities and technologies, now has a huge multitude of actors and stakeholders in its Agri-food chains. In future, their numbers and diversity will increase. It is now imperative for India in developing its agriculture that all its knowledge resources, surmounting all barriers be they economic, cultural, technological or political reach and are accessible to all the actors in India's Agri-food systems.

The Workshop deduced that meeting knowledge needs of the vast number of actors and stakeholders in India's rapidly developing, increasingly complex, open market driven Agri-food chains will require open access to data, information and the means to effectively use them as the most basic and essential of all their supporting structures. With the open access, the data and information must be linked, interoperable and reusable.

India recognizes that its agriculture needs to become more knowledge driven and has created Institutions to

support this need. India has a large network of organizations that manage agricultural data, information and knowledge. India has a widespread access to cellular telephony and broadband Internet access which is rapidly growing and advancing in technology. It has a world renowned skills base in information services. The Workshop revealed, through a representation of initiatives and activities, the status and capacities already present in developing open access information systems in the country. However, India has not been able to rapidly enable the effective use of information and information technology to improve its Agri-food systems and value chains as required.

The weaknesses are systemic owing to institutional lacunae in terms of inappropriate policies, strategies, governance and supporting organizations, in effectively using technology and not involving the private and community sectors to enable effective use of data, information and knowledge in its Agri-food systems. There is no strategy or roadmap to enable data and information management to develop Agri-food systems in the country. Most activities in agricultural data and information management appear to be isolated and dispersed with little efforts at integration and providing standardized data and information through common platforms. The most critical weakness is the lack of capacities, especially skills among users, to effectively use data and information for decision making and innovation.

The development of effective knowledge services based on open data and information access provides huge opportunities for developing India's agriculture in a sustainable and resilient manner, generating employment and in increasing its agricultural exports especially in high value items and commodities.

The threats to missing these opportunities lies in not investing, through the public sector, in the necessary Institutions, infrastructure, capacity development including education, enabling inclusion of the private and community sectors and taking advantage of the latest technologies.

India now needs to further elaborate its policies related to opening access to agricultural data, information and knowledge. It needs to strategize, possibly through a roadmap, on how it will improve knowledge access and use to develop its Agri-food value chains. India will need to revamp its existing Institutions and develop new Institutions and organizations for governance, management, integration and support to data, information and knowledge systems as also services for those engaged in agriculture, Agri-food systems and value chains.

It has to consider investment, especially through the public sector, and with inclusion of the private and community sector for ICT infrastructure, data and information management, governance, capacity development and in organizations that process and manage data and information as a public function. India also needs to effectively use technology for its knowledge systems. For this it will need to partner with and collaborate with International and foreign agencies and technology providers. For India, this could also be an opportunity to develop a skills base to participate in International knowledge services and technology markets related to Agri-food systems and chains.

The Workshop developed a set of recommendations covering some of the important policy, strategy, capacity development, infrastructure, content generation and management, integration of information systems and information content and enabling effective use of openly available data, information and knowledge issues.

The facilitators, using the outputs of the Workshop, have formulated a draft Roadmap for improving and strengthening open access to agricultural data, information and knowledge in India.

6. Framework of Recommendations and Action Points for the Roadmap to develop Open Information and Knowledge Systems for Agricultural Development in India

Using all the outputs from the sessions during the Workshop with the actions suggested by the delegates a Framework to further develop a Roadmap for Open Access to Agricultural Knowledge for Inclusive Growth and Development has been developed and is presented below.

Development of Policy

- There is a urgent need to enable creation of open access ecosystem in the lines of shared interests for faster and wider availability of agricultural information to all in India.

Attention: GOI, MOA, DARE, ICAR, State Departments, SAUs

- There is now a need for well-defined open access policies with necessary regulations for scientific and technological information and data taking into account privacy, security of information and information systems and needs of, such as standards, for integrating information and information systems in India.
- To encourage researchers and innovators in agriculture to share information openly. Career advancement policies in MOA, DARE, ICAR and SAUs need to be linked with contribution to open access movement. Articles in Open access journals and repositories to be given equal weightage along with those in commercial high impact factor journals by deploying effective peer review process for promotional assessment of scientists.

Attention: GOI, MOA, DARE, ICAR, State Governments

- A National Strategy through Ministry of Agriculture with lead from DARE/ICAR is now needed for availability, access and effective use of agricultural data and information for effective use in inclusive agricultural development.

Attention: GOI, MOA, DARE, ICAR, SAUs

- Action by DARE/ICAR, Department of Agricultural Extension and State nodal agencies for advocacy, awareness and use of open data and information and use by all stakeholders to agriculture and agricultural development.

Attention: DARE, ICAR, SAUs, State Governments

- Open access to incorporate professional ethics in respecting intellectual property rights for knowledge sharing and technological commercialization.

Attention: DARE, ICAR, SAUs

- There is an urgent need to establish Information Coordination Mechanisms at MOA, DARE and ICAR levels.

Attention: GOI, MOA, DARE, ICAR

Facilitation, Hardware, Software and Connectivity development for open access movement

- Cost of new generation Wi-Fi and 3G/4G enabled smart phones and tablets to be affordable by all in India.
- Broadband 3/4G Connectivity for all India for use in E-Agriculture along with e-governance, e-health, e-education etc.
- Data connectivity (broadband and 3G/4G) to be made affordable to rural areas.

Attention: GOI and concerned Ministries

- Agricultural applications, especially free and developed using open technologies and available as FOSS for use on mobile devices to be promoted and supported.

Attention: MOA, DARE, ICAR, SAUs

Collaboration with Public, Private, People/Community and International Organizations

- Proactive participation in International level discussions on standards for Agriculture information and knowledge resources including agriculture data with a role in setting global standards for agricultural data management and lead by incorporating these standards for Open Agriculture Knowledge and resources.
- Development of Agricultural knowledge grid starting from farm level for multilingual content development and stakeholders involvement.
- Promoting and enabling appropriate use of mobile devices and Tablet PC by farmers, producers and those involved in Agri-food chains through training and learning such as through Farm schools and Village Extension workers.
- Enabling development of applications by farmers, extension workers and others involved in Agri-food chains for strengthening open access movement through creative content management by users.
- Stakeholder participation through Public-Private-People/Community Partnerships to create open access ecosystem for Agri-food chains and complete open access cycle i.e. data-information-knowledge-consumers-impact.
- Partnership of ICAR with CIARD RING for creating CIARD RING India.

Attention: MOA, DARE, ICAR, SAUs, State Departments

Capacity Development

- Curriculum changes such as integrating data sciences in library science and related disciplines, and informatics in agricultural and related (Veterinary, animal, horticulture, fisheries) sciences at graduate and post graduate levels.
- Inclusion of 'Information literacy' in curriculum of course taught in Agri universities, institutes and also to be part of training for ICAR scientists.

Attention: SAUs

- Developing domain specific groups for Agro-ecologies, Commodities, Farming methods involving Farmers, Extension specialists, Processors, Experts, Scientists etc.

Attention: MOA, NGOs, DARE, ICAR, SAUs

- Developing standardized data sets with enhanced authenticity and reliability from local to national

level for use in agriculture and planning.

Attention: GOI, NIC, MOA and other Ministries

Content Related

Promotion of good open access practices for:

- Quality information content development.
- Clarifying the purpose of open access i.e. identifying collaborators, status of research, strengthening teaching community or economic aspects.
- Use of appropriate standards in harmony with international standards with common formats (e.g. RDF) for data and information across the organizations for information generation (data collection) and knowledge creation (information processing).

Cost effective knowledge through open access system

- Multi-lingual authentic material generation and placing it in an agricultural information cloud with an India Agricultural RING connecting all agricultural information services.
- ICAR and SAUs to develop and support development of open access applications.
- Creation of Institute and University level online open repository mirrored on agricultural information cloud (as above).

Attention: DARE, ICAR, SAUs

- Strengthening open access libraries and information centers at KVKs

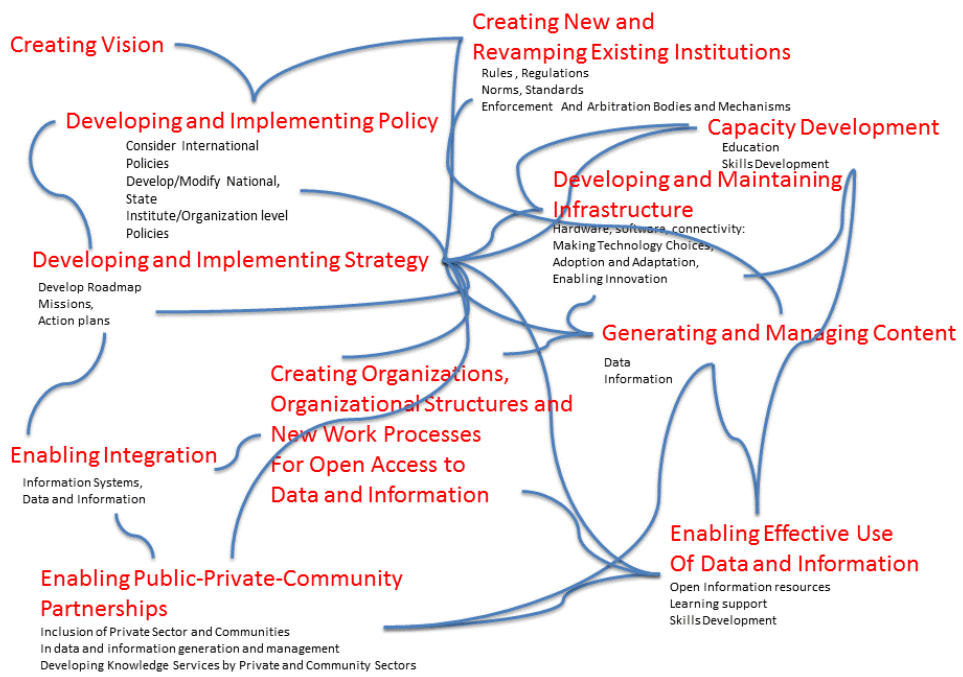
Attention: MOA, DARE, ICAR, SAUs

Improving quality of knowledge material with open access:

- Screening of data through institutional agencies before being made available through open access.
- Compatibility with existing knowledge, up-scalable information, value addition in information and bringing social orientation.

Attention: GOI, MOA, DARE, ICAR, CSOs

Figure 2: Draft Roadmap for Enabling Open Access to Agricultural Knowledge for Inclusive Growth and Development in India



7. Annexure I

Programme Schedule

Day-1: 29th October 2014

0915-0945	Registration
0945-0955	Welcome by Dr D. Rama Rao, Director, NAARM
0955-1000	Lighting of the Lamp
1000-1020	Opening Keynotes Dr Ajit Maru, Senior Knowledge Officer, FAO, Rome
1020-1040	Remarks by Guest of Honour Dr K.R. Murali Mohan, Adviser, DST and Head, Big Data Initiative Division, DST, New Delhi
Release of the 'Training Manual on Digital Repository'	
1040-1100	Remarks by Chairman Prof. M. Moni, Former DG, NIC, New Delhi
Vote of thanks	Dr S.K. Soam, Head, ICM Division, NAARM

Panellist Views: Global State of Open Knowledge Movement in Agriculture

Chair: Prof. M. Moni Co-Chair: Dr K.R. Murali Mohan Rapporteur: Dr. G.R.K. Murthy, Senior Scientist, NAARM	
1120-1140	The CGIAR and Open Knowledge Actions- Dr G. Dileepkumar, Global Leader, Knowledge Sharing & Innovation, ICRISAT, Hyderabad
1140-1220	CIARD, GODAN and FAO actions in Open Knowledge – Dr. ARD Prasad, Head, DRTC, Indian Statistical Institute, Bangalore AgInfra/RDA and open access movement- Dr. Devika Madalli, DRTC, ISI, Bangalore
1240-1300	Open access and Natural Resources Conservation- MsSonali Bisht, Adviser, INHERE, Masi (Almora)
Lunch 1300-1400	

Panellist Views: Current State of Open Movement in Agriculture in India

Technical Session-I

Chair: Dr ARD Prasad Co-Chair: Dr Sanjay Burde <i>Rapporteur:</i> Dr P. Venkatesan, Senior Scientist, NAARM	
14:00-: 14:20	Open Knowledge for Agriculture – Perspectives and Actions of ICAR- Dr Rameshwar Singh, Director, ICAR- DKMA, New Delhi
14:20-14:35	Open Knowledge for Agricultural Extension – Dr. V.P Sharma, Director, (ICT & Documentation) MANAGE, Hyderabad
14:35-15:00	Framework for agriculture content development: eSagu and eAgromet experiences – Dr P. Krishna Reddy, Professor, IIIT-H, Hyderabad
15:00- 15:15	SahajaAharam: Experiences for Open Farming Knowledge- Dr.G.V. Ramanjaneyulu, <i>Executive Director, Centre for Sustainable Agriculture, Hyderabad</i>

Technical Session-II

Chair: Dr Rameshwar Singh Co-Chair: Dr Devika Madalli <i>Rapporteur:</i> Dr K.H. Rao Principal Scientist, NAARM	
15:30-15:50	Digital Green: Experiences in Open Agricultural Knowledge – Mr. Pritam Nanda, General Manager, Digital Green, Hyderabad
15:50-1610	Agroforestry Research: Open Access- Dr S.K. Dhyani, Director, NRC Agroforestry, Jhansi
16:10-16:30	Open Access initiatives in CSIR- Dr Sanjay Burde, Principal Scientist, NISCAIR, New Delhi
16:30-16:50	CERA, Koha and the Open Access to Agricultural Information by Dr A.K. Jain, (Former ADG, ICAR), IARI, New Delhi
1650- 1700	Open Access: Capacity building initiatives at NAARM- Dr S.K. Soam, Head, ICM Division, NAARM
Evening tea and snacks / Reception	

Day-2: 30th October 2014

Workshop	
Chair: Dr. ARD Prasad, Head, DRTC, ISI, Bangalore Co-Chair: DrSonali Bisht, Director, INHERE, Almora	
Session-I: 09:00-10:30: SWOT of the Open Knowledge for Agriculture Movement in India and Identification of needs to improve open knowledge access and use for agriculture in India Moderator: Dr. V.P. Sharma, Director (ICT & Documentation), MANAGE, Hyderabad	
Session-II 11:00-13:00: Actions to further strengthen Open Knowledge for Agriculture in India including for Agricultural Knowledge Entrepreneurship Moderator: Dr. Krishna Reddy, Professor, IIIT, Hyderabad	
Session-III 14:00-15:30: Collaborations within India between Public, Private and Community Sectors in India and with International actors in Open Knowledge Moderator: Dr. DevikaMadalli, ISI, Bangalore	
15:30-15: Tea Break	

Plenary: Policy and Recommendation	
Chair: Dr D. Rama Rao, Director, NAARM Co-Chair: Dr Rameshwar Singh, Director, DKMA	
1545-1600	Breakout session reports by the Moderators [each 05 minutes]
1600-1610	Remarks by Dr Ajit Maru, Senior Knowledge Officer, FAO
1610- 1620	Remarks by Dr Rameshwar Singh, Director, DKMA
1620-1640	Remarks by Dr D. Rama Rao, Director, NAARM
1640-1700	Closing Remarks by Chief Guest Dr J.C. Katya, Former DDG (Edn), ICAR
Vote of Thanks by Dr S.K. Soam, Head, ICM Division, NAARM	
Evening tea and snacks	

8. Annexure II

Workshop Participants

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9. Annexure-III

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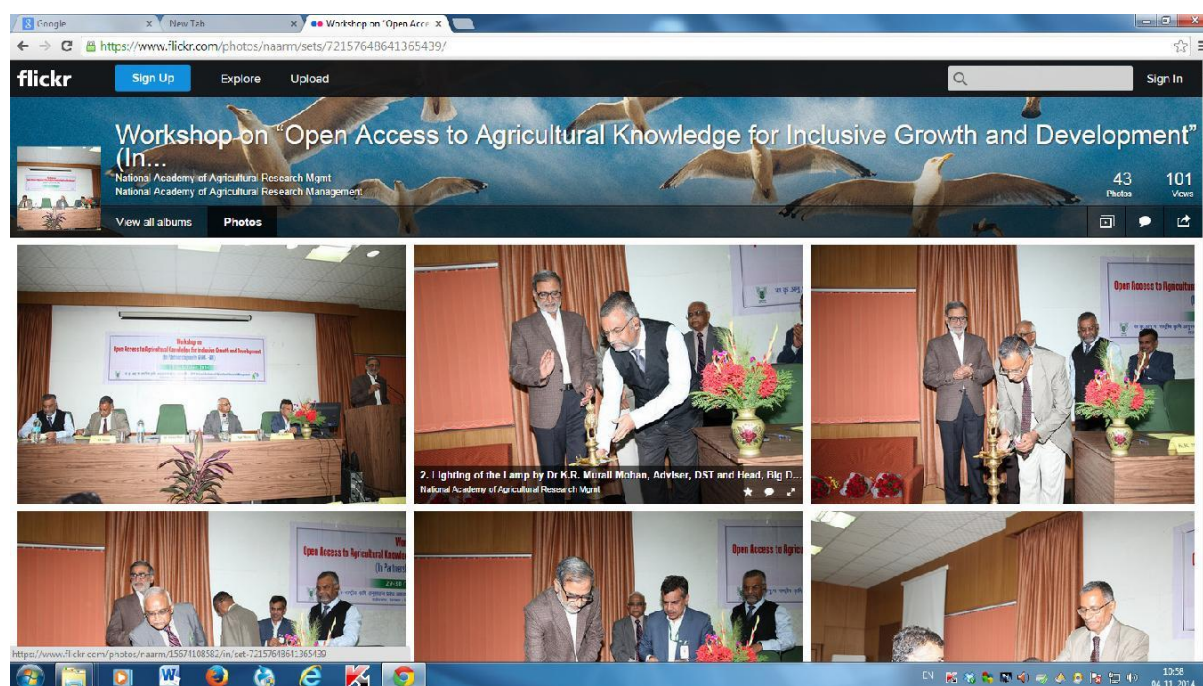
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10. Annexure-IV

WEB COMMUNICATION

1. Link for Workshop photos Flickr at NAARM

<https://www.flickr.com/photos/naarm/sets/72157648641365439/>
<https://www.flickr.com/photos/naarm/sets/72157648641365439/>



2. Link for Program schedule, PPTs of resource persons, Lecture note of Prof Moni and Tweets from participants

<https://storify.com/PraveenaSridhar/open-access-in-agriculture-in-india>



3. GFAR WEBSITE

<http://www.egfar.org/news/open-access-agricultural-knowledge-inclusive-growth>

The screenshot shows the GFAR website with a purple header. The main content area features a news article with a photo of a group of people at a workshop. The article text discusses the importance of open access to agricultural knowledge in India, mentioning a workshop organized by NAARM and CIARD. The website has a navigation menu with options like 'About Us', 'Our Work', and 'Information gateway'. A sidebar on the left lists various categories like 'News', 'Publications', and 'Events'.

4. ICAR Website

<http://www.icar.org.in/en/node/8258>

The screenshot shows the ICAR website with a green header. The main content area features a news article titled 'NAARM Organizes Workshop on Open Access in Agriculture' dated 29th October, 2014, in Hyderabad. The article includes several photographs of the workshop proceedings, including a group of people on a stage and a speaker at a podium. The text describes the workshop's focus on open access to agricultural knowledge and mentions speakers like Dr. Ajit Maru and Prof. M. Moni. The website has a navigation menu on the left and a sidebar on the right with search and social media options.